

- [54] GAS GENERATOR ASSEMBLY  
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 [22] Filed: Mar. 29, 1973  
 [21] Appl. No.: 345,992

Related U.S. Application Data

- [62] Division of Ser. No. 180,558, Sept. 15, 1971, Pat. No. 3,756,785.  
 [52] U.S. Cl. .... 89/1 B; 128/203  
 [51] Int. Cl. .... A62b 7/08  
 [58] Field of Search ..... 23/281; 89/1 B; 42/70; 102/8; 128/203

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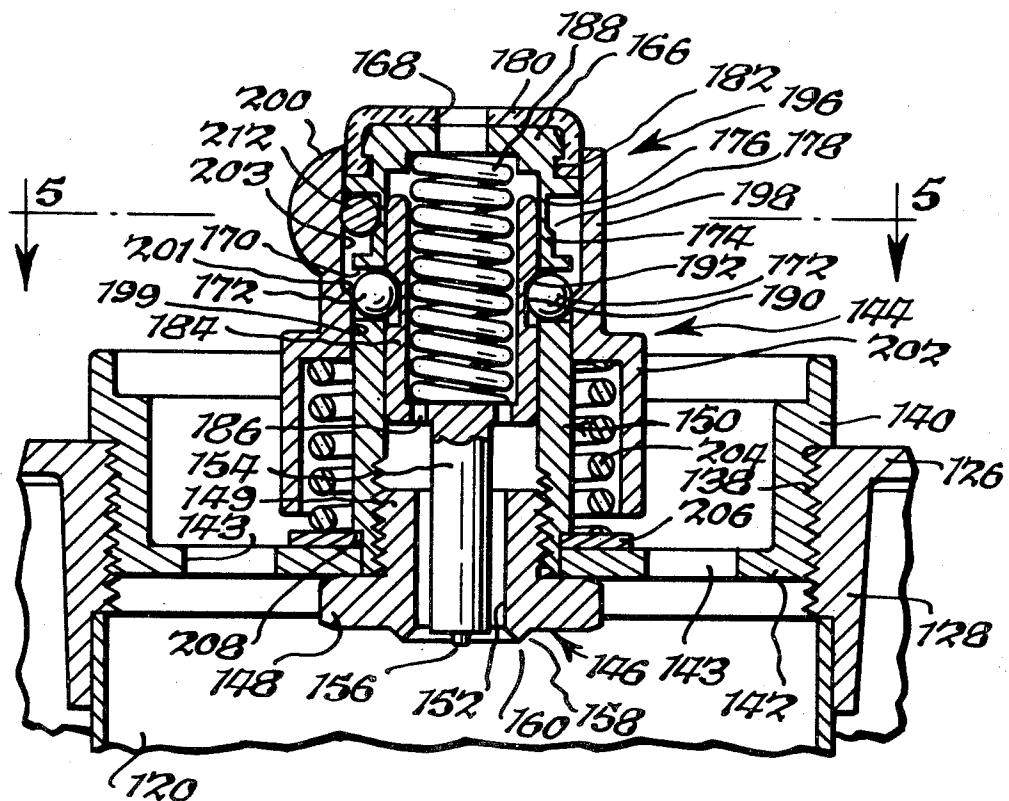
Primary Examiner—Verlin R. Pendegrass  
 Attorney, Agent, or Firm—Christel & Bean

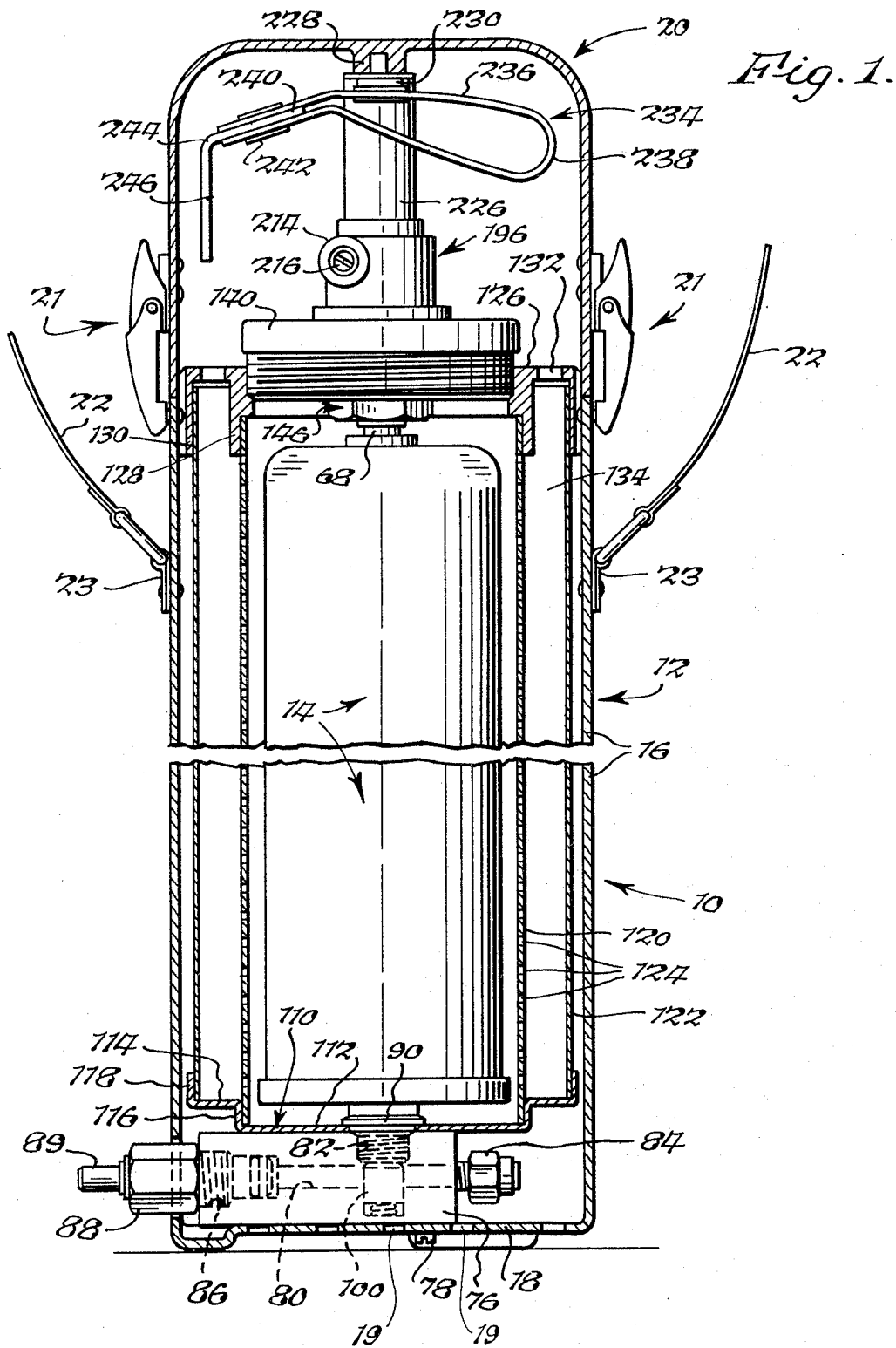
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ABSTRACT

A gas generator assembly comprising a housing containing an oxygen evolving cartridge in spaced relation to the housing. A manually operable actuating mechanism, easily reset or cocked by hand, is releasably secured in the housing in spaced relation to the cartridge for igniting the oxygen candle therein. A safety release pin locks the actuating mechanism in the cocked position to prevent inadvertent ignition of the candle.

9 Claims, 9 Drawing Figures





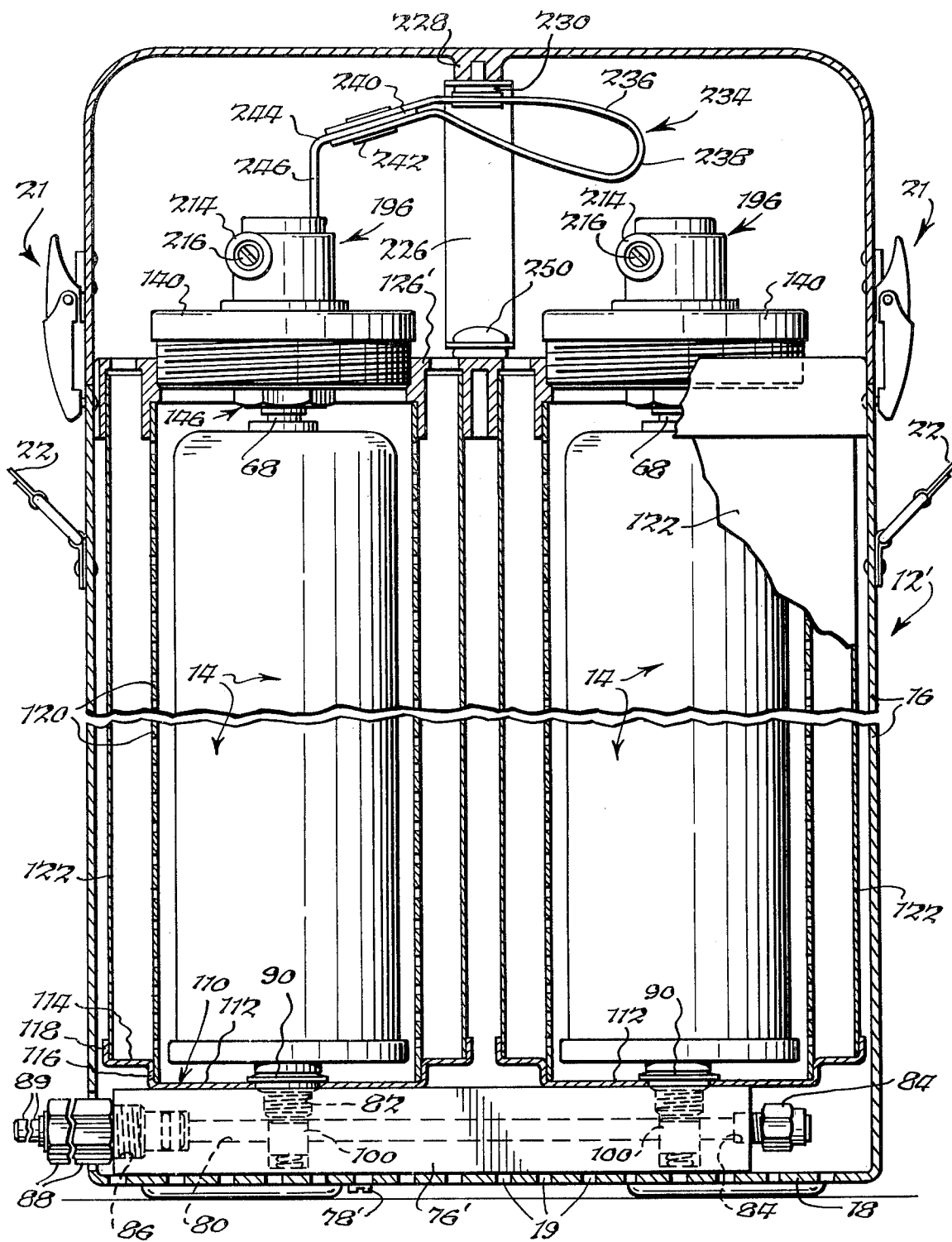
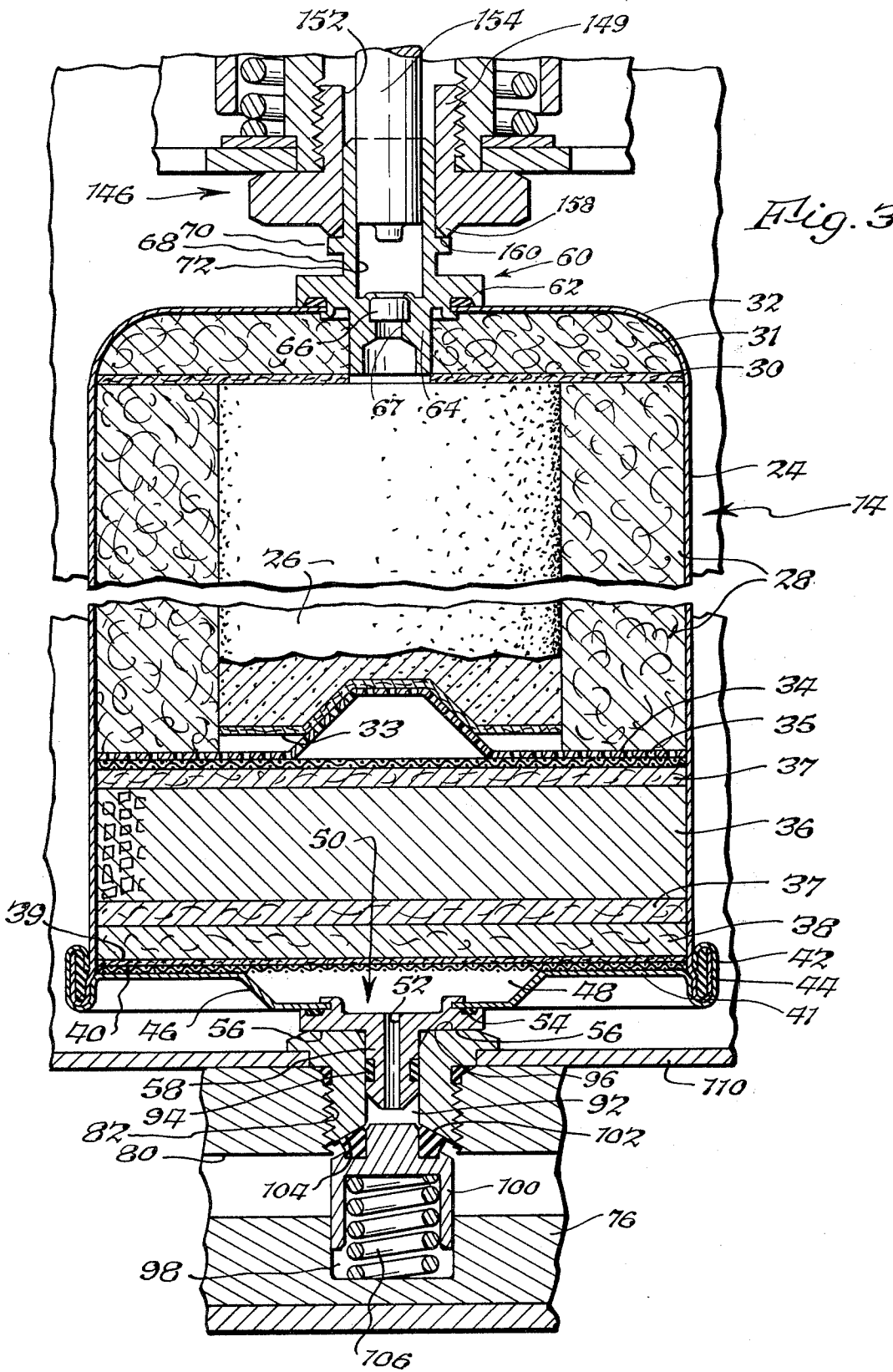


Fig. 2.

SHEET 3 OF 4





## GAS GENERATOR ASSEMBLY

## CROSS REFERENCE TO A RELATED APPLICATION

This application is a division of pending application Ser. No. 180,558, filed Sept. 15, 1971, now U.S. Pat. No. 3,756,785.

## BACKGROUND OF THE INVENTION

This invention relates to a gas generator and, more particularly, to a self contained oxygen-evolving apparatus especially adapted for regular use by patients having respiratory ailments and for respiratory and cardiac emergencies.

Gas generators comprising oxygen evolving chlorate candles mounted in cannisters or containers are known, and offer certain advantages over cylinders of oxygen under pressure. Often, these known generators employ an over-the-center type of percussion actuator, which not only is difficult to cock for repeated action, but requires locating the primer in close proximity to the actuator. Since the heat of combustion of the primer and candle is intense, the actuator and container reach excessive temperature. While such oxygen evolving generators are very useful in many emergency situations, such as might be encountered in submerged watercraft or high flying aircraft, they present a problem when used by respiratory patients or by medical personnel whose handle such generators and trigger the actuator by hand. Also, the difficulty in manually resetting or cocking the actuator for subsequent use with a freshly replaced oxygen candle renders them unsuitable for repeated usage by respiratory patients and by medical personnel.

## SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved solid state gas generator assembly having a novel actuator that can be easily reset for repeated usage.

It is another object of this invention to provide the foregoing gas generator assembly with an actuator arrangement facilitating an optimal design relation between the primer and candle body and between the generator and the operator.

It is a further object of the present invention to provide a novel solid state gas generator housing having spaced heat dissipating and heat shielding means to preclude undesirable heat transmission to the housing.

It is still another object of this invention to provide the foregoing gas generator assembly with a self contained chemical oxygen evolving unit having means affixed to the opposite ends thereof for properly orienting such unit in a spaced relation to the actuator and the associated housing.

In one aspect thereof, the gas generator assembly of the present invention is characterized by the provision of stud means affixed to the opposite ends of an oxygen evolving cartridge for spacing the latter from the ignition actuating mechanism and from the housing walls. The ignition actuating mechanism is easily operated and reset by hand and is provided with a locking mechanism to prevent inadvertent firing. An inner heat dissipating liner and an outer heat shield spaced therefrom are interposed between the oxygen evolving cartridge and the housing.

The foregoing and other objects, advantages and characterizing features of the present invention will become clearly apparent from the ensuing detailed description of an illustrative embodiment thereof, taken together with the accompanying drawing wherein like reference numerals denote like parts throughout.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of one form of a gas generating assembly of the present invention;

FIG. 2 is a longitudinal sectional view of another form of gas generating assembly of this invention;

FIG. 3 is a fragmentary vertical sectional view, on an enlarged scale, showing the oxygen evolving unit and a portion of the ignition mechanism therefor;

FIG. 4 is a fragmentary vertical sectional view, on an enlarged scale, showing details of the ignition actuating mechanism in its locked, cocked position;

FIG. 5 is a transverse cross sectional view taken about on line 5—5 of FIG. 4;

FIG. 6 is a view similar to FIG. 4, showing the ignition actuating mechanism in its released, firing position;

FIG. 7 is a transverse cross sectional view taken about on line 7—7 of FIG. 6;

FIG. 8 is a transverse cross sectional view taken about on line 8—8 of FIG. 6; and

FIG. 9 is a transverse cross sectional view taken about on line 9—9 of FIG. 6.

## DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now in detail to the drawings, there is shown in FIG. 1 an illustrative embodiment of an oxygen generator assembly, generally designated 10, constructed in accordance with this invention, comprising a housing 12 for enclosing an oxygen generator cartridge 14. Housing 12 is of a generally cylindrical configuration and comprises a cylindrical tubular shell 16, a bottom end wall 18 having perforations 19 there-through, and a top end cover 20. Cover 20 is releasably secured to shell 16 by any suitable means, such as a pair of conventional toggle-type safety locks 21 for example. A strap 22 is connected to shell 16 by means of suitable fasteners 23 and is adapted to be looped over the head and about the neck of the user for supporting generator 10 preferably adjacent one side of the user in the area of the hip region. The terms top, bottom, upper, lower and the like are used for convenience of description with reference to the drawings and are not used in a limiting sense.

As shown in FIG. 3, oxygen generating cartridge 14 comprises a cannister 24 encasing an inner body composition capable of evolving oxygen upon burning. By way of example, the composition can consist of a consolidated core body, hereinafter referred to as an oxygen candle 26, having uniformly distributed there-through an alkali metal chlorate or perchlorate which generates oxygen, a finely divided oxidizable material such as iron powder for burning and supplying part of the heat needed for release of oxygen through an exothermic reaction, a binder such as inorganic glass fibers or steel wool for holding the mass together and aiding in the even decomposition of the chlorate or perchlorate, and barium peroxide or like chlorine fixes for chemically eliminating traces of chlorine gas released during thermal breakdown of the chlorate or perchlorate. Such oxygen candle compositions are known and,

per se, form no part of the present invention. The body of oxygen candle 26 can be press-molded or cast to form a cylinder having an ignition area located centrally at the upper end thereof, such ignition area comprising the foregoing composition enriched with a metal powder, such as iron, to provide a concentrated area of intense heat when ignited.

Candle body 26 is encased within a heat insulating envelope 28 of filter medium interposed between candle body 26 and cannister 24 to insulate the latter from the heat of combustion. Envelope 28 can be formed of fiberglass and, if desired, impregnated with a silicate or other hardening agent in an amount sufficient to make the envelope shape sustaining in the desired form. In the illustrative embodiment depicted in FIG. 3, an annular pad 30 is mounted on top of candle 26 and envelope 28 in spaced relation to the top end wall 32 of cannister 24. A fiberchrome filter 31 is interposed between pad 30 and cannister top end wall 32. The bottom end of candle 26 is provided with a fiberfrax disc 33 having an inwardly dished portion resting on the complementary inwardly dished portion of a perforated baffle plate 34 supported on a metallic screen 35. A layer of catalyst 36, such as the well known Hopcalite, is sandwiched between a pair of fiberfrax discs 37 beneath oxygen candle 26 and is effective to oxidize to carbon dioxide any carbon monoxide that may result from the combustion of oxygen candle 26. The lower disc 37 is supported on a micro quartz pad 38 which, in turn, is supported on a fiberglass pad 39 resting on a metallic screen 40. Screen 40 rests against the inner surface of a cannister cover or bottom end wall 41, which is provided with an inturned, curved flange 42 at the marginal edge thereof rolled into sealing relation with an annular bead 44 forming a continuation of the cannister body and located at the bottom end thereof. Thus, in forming cartridge 14, the foregoing components are inserted through the bottom open end of cannister 24 and then sealed by cover 41.

Bottom end wall 41 is formed with an outwardly dished portion 46 defining a chamber 48 into which filtered oxygen is collected. A stud, generally designated 50 and having a bore 52 therein, is suitably attached to portion 46 of bottom wall 41 and is maintained in a gas tight relation therewith by means of a suitable seal 54. Stud 50 is provided with an annular abutment shoulder 56 and a tubular body 58 adapted to be received in a manifold coupling as will hereinafter become apparent.

Mounted on upper end wall 32 of cannister 24 in a gas tight relation therewith is a stud 60 having a flange 62 and a cylindrical body 64 extending downwardly from flange 62 to pad 30, which is provided with a central opening communicating with candle 26. A primer 66 is mounted within body 64 and communicates with the ignition area of oxygen candle 26 through a bore 67 provided in body 64. Stud 60 also includes a tubular body portion 68 extending upwardly from flange 62 and having an annular flange 70 spaced from flange 62. Body portion 68 is adapted to be received in a retainer forming part of the primer actuating mechanism and is bored as at 72 to receive a firing pin, hereinafter more fully described. The oxygen generating cartridge 14 thus far described includes studs 50 and 60 and constitutes a disposable, self-contained unit which, when spent, can be replaced by a fresh unit in housing 12.

A manifold 76 is suitably secured to bottom end wall 18 of housing 12 (FIG. 1) as by means of screws 78 and

is provided with a longitudinal passage 80 communicating with a tapped opening 82. One end of passage 80 leads to a port having a pressure relief valve 84 suitably threaded therein. The other end of passage 80 leads to a port 86 connected to a coupling 88 having a hose fitting 89 for connection to a flexible delivery tube (not shown) connected at its other end to the usual face mask, also not shown. The mask, delivery tube and a fitting connection when not in use, can be stored within cover 20. A fitting 90 is threaded into tapped opening 82 in a gas tight relation therewith and is provided with a bore 92 for receiving tubular body 58 of stud 50. A seal 94 is disposed in a peripheral groove formed in body 58 to provide pressure sealing between body 58 and fitting 90. Fitting 90 is provided with an outer face 96 which serves as a seating surface for shoulder 56 of stud 50.

A cavity 98 is formed in manifold 76 in registry with opening 82 for receiving a check valve 100 therein. Check valve 100 is provided with a beveled resilient sealing surface 102 adapted to engage a beveled valve seat 104 formed on the end of fitting 90. Valve 100 is normally biased against valve seat 104 by means of a helical spring 106 disposed between the rear face of valve 100 and the bottom of cavity 98. The filtered oxygen under pressure generated by the combustion of candle 26 flows from chamber 48 through bore 52 of stud 50 and acts against valve 100 to urge the latter away from its seat 104, allowing the oxygen to flow through opening 82, passage 80, port 86, coupling 88 and ultimately to the user. Excess pressures are dissipated through relief valve 84 in the usual manner.

A support plate 110 is mounted within the lower end of housing 12 (FIG. 1) between manifold 76 and a stepped flange on fitting 90. Plate 110 has a generally circular planar portion 112 and an offset ledge 114 connected to portion 112 by an annular shoulder 116 and terminating in an annular flange 118. Plate 110 supports the lower ends of a pair of concentric, cylindrical liners 120 and 122 the inner liner 120 being mounted in spaced relation to cartridge 14 and perforated as at 124 for dissipating the heat generated by the combustion of candle 26. The lower end of liner 120 is supported on the planar portion 112 of plate 110 against shoulder 116. Outer liner 122, which serves as a heat shield, is spaced radially from liner 120 and is supported at its lower end on ledge 114 against flange 118. The upper ends of liners 120 and 122 are supported in spaced relation by means of a retainer member 126 bonded or otherwise fixedly secured to the upper end of housing shell 16. Member 126 has spaced cylindrical partitions 128 and 130 for embracing the upper ends of liners 120 and 122. A plurality of passages 132 are provided in member 126 and connect an annular passage 134 defined between liners 120 and 122 to the ambient atmosphere when cover 20 is removed from shell 16. Heat is dissipated during combustion of candle 26 by convection through the perforated liner 120 and upwardly through passages 134 and 132 to the ambient atmosphere. Liner 122 serves as a heat shield retaining the heat within passage 134 and preventing the transmission of heat to housing 12 thereby protecting the user against burning contact with housing 12. Member 126 is provided with a central tapped opening 138 for receiving a cup-shaped casing 140 threadably secured therein and provided with a bottom wall 142 for supporting an ignition actuating assembly,

generally designated 144 (FIG. 4). Bottom wall 142 is provided with a plurality of openings 143 connecting the area within liner 120 with the ambient atmosphere to aid in the dissipation of heat generated by candle 26 during combustion.

As best shown in FIGS. 4-8, actuating assembly 144 comprises a retainer 146 having a flange 148 engaging against the underside of bottom wall 142 and a body portion 149 threadably secured to an actuator 150. Retainer 146 has a bore 152 therein for receiving the upper portion of tubular body 68 of stud 60 (FIG. 3) and a firing pin 154 having an axial projection 156 adapted to strike primer 66 for firing the latter. Flange 148 is provided with an annular rib 158 of generally triangular cross section having an annular apex portion 160 adapted to seat against stud flange 70 (FIG. 3) of cartridge 14 for properly locating the parts in the assembled relation. The entire actuating assembly 144 is assembled as a unit to cartridge 14 by inserting the upper end of stud 60 into bore 152 of retainer 146 and then threading casing 140 into opening 138 of member 126 until rib 158 seats against flange 70. Bore 72 of stud 60 is coaxially aligned with bore 152 of retainer 146 for receiving the end portion of firing pin 154 in the assembled relation with the upper portion of tubular body 68 interposed between retainer 146 and firing pin 154.

Actuator 150 comprises a generally cylindrical body 164 having an end wall 166 provided with a central opening 168 therein. Body 164 is provided with four circumferentially spaced openings 170 for receiving balls 172 as shown in FIG. 8. Of course, more or less than four openings 170 and a corresponding number of balls 172 can be provided, as desired. Body 164 is provided with a reduced diameter portion 174 and a further reduced diameter portion 176 separated by a beveled shoulder 178 for a purpose hereinafter explained. An insulator cap 180 is mounted on the upper end of body 164 about end wall 166 and is provided with an annular bead 182 received in a peripheral groove formed in body 164.

Firing pin 154 is provided with a cup-shaped member 184 formed integral therewith and telescopically received within actuator body 164. Member 184 is provided with openings 186 adjacent firing pin 154 to permit the heat of candle 26 to escape by convection. A compression spring 188 is mounted within member 184 for biasing firing pin 154 toward primer 66. Member 184 is provided with a peripheral groove 190 having a beveled cam surface 192 extending from groove 190 to the outer peripheral surface of member 184. Groove 190 receives portions of balls 172 when aligned with openings 170 of actuator 150 as shown in FIG. 4 and cam surface 192 aids in ejecting balls 172 out of groove 190 upon downward movement of member 184 relative to actuator 150.

An actuator sleeve 196 is mounted about actuator 150 for sliding movement relative thereto and comprises a hollow body 198 having an inner wall surface 199 and formed with an elongated enlargement 200 (FIG. 5) at one side thereof extending generally normal to the axis of body 198. As shown in FIG. 9, a portion of the inner wall surface of body 198 is flat sided as at 195 and complementary to a flat side portion 197 of actuator body 164 to prevent relative rotation therebetween. Thus, bodies 164 and 198 can move axially relative to each other but are keyed against relative rota-

tional movement. The inner wall surface 199 of the upper portion of sleeve body 198 is provided with an annular beveled shoulder or cam surface 201 leading to an enlarged inside diameter portion 203. The lower portion of body 198 is provided with an enlarged cup-shaped configuration having a cylindrical wall 202 radially spaced from actuator body 164 for receiving a compression spring 204 therein. The lower end of spring 204 abuts against a washer 206 supported between casing bottom wall 142 and an annular shoulder 208 provided adjacent the lower end of actuator body 164.

Enlargement 200 is provided with axially aligned bores 210 for receiving an elongated safety lock shaft 212, the central portion of which passes between portion 202 of sleeve body 198 and portions of the outer peripheral surface of actuator body 164. Enlarged heads 214 are secured to the opposite ends of shaft 212 as by means of suitable fasteners 216. These heads 214 are adapted to be received in cavities 218 provided at the opposite ends of enlargement 200. Shaft 212 is provided with an intermediate reduced diameter portion 220 having annular, bevelled shoulders or cam surfaces 222 leading to the outer peripheral surface of shaft 212. Shaft 212 is adapted to be shifted axially into a locked position as shown in FIGS. 4 and 5 whereby actuator sleeve 196 and actuator body 164 are keyed together and into a release position as shown in FIG. 7 whereby sleeve 196 can be moved vertically relative to actuator body 164.

Prior to use, the various components of actuating assembly 144 are in the relative positions shown in FIGS. 4 and 5 with safety lock shaft 212 captively held between portion 203 of actuator sleeve 196 and the reduced diameter portion 176 of actuator body 164. Thus, actuator sleeve 196 and body 164 are keyed together preventing relative sliding movement therebetween. Also, balls 172 are captively disposed in openings 170 of actuator body 164 and partially in peripheral groove 190 of member 184. In this position, balls 172 lock member 184 upwardly against the bias of spring 188, thus maintaining firing pin 154 upwardly within bore 152 in a cocked position.

In use, strap 22 is placed about the user's neck region in a manner supporting generator 10 along one side of the user and the toggle-type safety locks 21 are released. Cover 20 can then be removed from housing 12 and the breathing mask and delivery tube removed and connected to coupling 89. The breathing mask is not placed about the user's mouth until the oxygen generator is actuated and the oxygen evolving process initiated. Cover 20 is left dangling from generator 10 by means of a tether strap 226 connected at one end thereof to a central boss 228 in end cover 20 by a fastener 230 (FIG. 1) and connected at the other end to member 126 by any suitable means (not shown). Thus, although cover 20 is removed from housing 12 to expose actuating assembly 144, it remains attached thereto by strap 226 so as to prevent misplacement thereof.

The user then shifts safety lock shaft 212 axially to position the reduced diameter portion 220 between portion 203 of actuator sleeve 196 and portion 176 of actuator body 164 to permit actuation of assembly 144. To initiate the oxygen evolving process, actuator sleeve 196 is slid downwardly relative to body 164 against the bias of spring 204 to the position shown in FIG. 6. This



relative movement can be effected due to the reduced diameter portion 220 of shaft 212 which readily fits into the space between portion 203 of sleeve 196 and portion 174 of body 164.

Upon relative sliding movement between sleeve 196 and body 164, the larger inside diameter portion 203 of sleeve 196 provides a wider space for receiving balls 172 which are cammed radially outwardly from grooves 190 by cam surface 192 under the influence of spring 188. Member 184 is thereby released allowing the force of spring 188 compressed therein to drive firing pin 154 downwardly into contact with primer 66 for igniting the latter and initiating ignition of oxygen candle 26. When firing pin 154 is released, the various components of actuating assembly 144 are in the relative positions shown in FIG. 6. The evolved oxygen passes through chamber 48, bore 52 of stud 50 and bore 92 of fitting 90. The pressure of the evolved oxygen builds up and acts against the face of check valve 100 until such pressure overcomes the bias of spring 106 to unseat valve 100. The oxygen escapes past check valve 100, through passage 80, port 86, coupling 88, hose fitting 89 and the delivery tube to the face mask at a rate sufficient to meet the oxygen consumption of the user. Excess pressures are relieved through valve 84.

The heat generated by the combustion of oxygen candle 26 is dissipated by convection through perforated liner 120, passage 134, 132 and outwardly through the open end of housing 12 into the ambient atmosphere. Perforations 19 in bottom end wall 18 permit cool air to communicate with the interior of housing 12 to ventilate the latter and facilitate such heat dissipation. Any heat transmitted upwardly is dissipated through openings 143 in member 126 and through retainer bore 152, openings 186, the interior of cup-shaped member 184, and outwardly through aligned openings in end wall 166 and cap member 180. Outer liner 122 serves as a heat shield and aids in directing the heat upwardly through passage 134. Housing wall 16, which is spaced from liner 122, is virtually unaffected by the intense heat generated by oxygen candle 26, which heat is dissipated outwardly through perforated liner 120 and upwardly by convection through the open end of housing 12. Also, the suspension of cartridge 14 within housing 12 at only two points by means of studs 50 and 60 significantly contributes to the dissipation of heat away from housing 12. As a result, the temperature of housing shell 16 remains low and is harmless against human contact therewith. This is especially significant when it is realized that cannister 24 maintains a temperature of approximately 400°F during normal combustion of the candle.

The size and the oxygen evolving duration of cartridge 14 can vary, as desired. Also, oxygen candle 26 can be of the multi-stage ignition type providing full flow operation at the mask within a predetermined minimal time limit and providing a minimum rate of relatively high oxygen flow for the first few minutes followed by a smooth transition to a minimum rate of reduced oxygen flow for the remainder of the oxygen evolving duration. However, once candle 26 is ignited, it will continue to burn until expended.

In order to replace a spent cartridge 14 with a fresh one and to reset actuating assembly 144 for subsequent operation, cover 20 is removed and casing 140 is threaded out of retainer member 126, carrying with it

the entire ignition actuating assembly 146 to expose cartridge 14. To facilitate the removal of a spent cartridge 14, a tool 234 (FIG. 1) is releasably mounted in cover 20 as by means of a spring clip 236 fixed to fastener 230.

Tool 234 comprises a strip 236 of metal reversely bent to form a loop 238 which serves as a handle for tool 234. The reversely bent portion is spaced from the main strip portion by a spacer element 240 and is connected thereto by means of a suitable fastener 242. The distal end of tool 234 is bent inwardly as at 244 and is bifurcated to provide spaced fingers 246 (only one of which is shown in FIG. 1) adapted to engage about body portion 68 of stud 60 below flange 70. The angular bend 244 in tool 234 facilitates the entry of fingers 246 into opening 138 of retainer member 126 and the positioning thereof about stud 60 so as to apply upward pressure against flange 70 and raise cartridge 14 out of housing 12. A fresh cartridge 14 can then be placed in housing 12 with tubular body 58 of stud 50 inserted within fitting 90 until shoulder 56 abuts against face 96 of fitting 90. Thus, cartridge 14 is correctly positioned within housing 12 in readiness to receive actuating assembly 144, which must be reset and cocked prior to assembly with cartridge 14.

When actuating assembly 144 is detached from retainer member 126, the various parts thereof are in the relative positions shown in FIG. 6. In order to reset or cock actuating assembly 144, firing pin 154 is forced within actuator body 150 against the bias of spring 188. When groove 190 is aligned with openings 170 in body 150, balls 172 will be shifted inwardly by cam surface 201 actuator sleeve 196 under the influence of spring 204. Actuator sleeve 196 is then free to move upwardly relative to body 150 under the urging of spring 204, carrying safety lock shaft 212 therewith. The various parts of actuating assembly 144 are then in the relative positions illustrated in FIG. 4 and firing pin 154 is held in its cocked position by means of balls 172. Lock shaft 212 is shifted axially to lock actuating sleeve 196 in its raised position to prevent inadvertent release of firing pin 154. Casing 140, together with actuating assembly 146 in its cocked position, can then be assembled to retainer member 126 and cartridge 14 in a manner hereinbefore described.

FIG. 2 illustrates another form of an oxygen generator assembly of this invention which is similar to the form of the invention first described except that the housing, identified by numeral 12', is made larger to contain two cartridges 14, which may be serially activated to produce a substantially continuous flow of oxygen when one of the cartridges 14 is spent. As shown in FIG. 2, manifold 76' is substantially longer than manifold 76 to receive the output of both cartridges 14. Retainer member 126' also is different in construction in order to accommodate both cartridges 14 and their actuating assemblies 144. However, each cartridge 14 is provided with its own inner and outer liners, 120 and 122, respectively, in a construction similar to that first described. FIG. 2 also illustrates the use of a fastener 250 fixed to member 126' for securing the other end of tether strap 226 thereto preventing complete detachment of cover 20 and possible misplacement thereof. The other elements shown in FIG. 2 are identical to those described in connection with the first form of the invention and are identified by similar reference characters.

An advantage residing in the second form of this invention is that the second cartridge can be ignited just prior to the depletion of the first to provide a continuous flow of oxygen to the user, if required. While the second cartridge is being consumed, the first can be replaced by still another cartridge to insure a continuous supply, when needed. Of course, the present invention contemplates the use of any number of cartridges 14 suitably mounted in a common housing, as desired.

From the foregoing, it is apparent that the objects of the present invention have been fully accomplished. As a result of this invention, an oxygen generator is mounted within a housing in spaced relation thereto and is provided with means for dissipating the heat released from the burning generator by convection away from the housing to enable the latter to be safely handled by the user during combustion. An easily cocked, manually operable actuating mechanism is releasably mounted in the housing in spaced relation to the generator to prevent overheating of the actuator.

Certain embodiments of this invention having been described and illustrated in detail, it is to be understood that this has been done by way of illustration only.

I claim:

1. In combination with oxygen evolving apparatus adapted to be carried with the user; a manually operable actuating mechanism for igniting an oxygen evolving candle in said apparatus comprising: a casing; a retainer mounted in said casing adapted for connection to a cartridge containing an oxygen evolving candle, an actuator body mounted in said casing, said actuator body having adjacent peripheral surface portions of different dimensions, a firing pin mounted in said actuator body and movable from a cocked position to a firing position, means biasing said firing pin to said firing position, means retaining said firing pin in said cocked position against said biasing means, means for disabling said retaining means enabling said firing pin to move to said firing position, said disabling means comprising an element movably mounted on said actuator body for movement between a first position where said retaining means maintains said firing pin in said cocked position to a second position disabling said retaining means, and means locking said disabling means to prevent actuation of said firing pin into said firing position, said locking means comprising an elongated element having adjacent portions of different cross section and mounted in said disabling element for movement between a locked position wherein said locking element engages said actuator body on the periphery thereof with one of said portions of said locking element engaging one of said peripheral surface portions of said actuator body in a manner preventing relative movement between said disabling element and actuator body and a release position wherein said locking element is disengaged from the periphery of said actuator body in a manner allowing relative movement between said disabling element and actuator body.

2. An actuating mechanism according to claim 1 wherein said retaining means includes an extension on said firing pin provided with an annular groove, a plurality of openings in said actuator body, and means keying said firing pin extension to said tubular body when said openings are in registry with said groove.

3. An actuating mechanism according to claim 2 wherein said disabling means comprises a sleeve slid-

able relative to said actuator body and having an enlarged inner diameter portion enabling said keying means to be displaced from said groove in said actuator to permit said firing pin to be driven by said biasing means.

4. An actuating mechanism according to claim 1 wherein said locking means comprises an elongated shaft having a reduced diameter portion movable between a position locking said disabling means and a position relasing said disabling means.

5. An actuating mechanism for igniting an oxygen evolving candle comprising: a casing; a retainer mounted in said casing adapted for connection to a cartridge containing and oxygen evolving candle, an actuator body mounted in said casing, a firing pin mounted in said actuator body and movable from a cocked position to a firing position, means biasing said firing pin to said firing position, means retaining said firing pin in said cocked position against said biasing means, means for disabling said retaining means enabling said firing pin to move to said firing position and locking means comprising shaft means movably connected to said disabling means in a manner permitting limited axial movement of said shaft means, said shaft means having different diameter portions between the ends thereof and a pair of stop members spaced axially from said different diameter portions for abutting said disabling means to limit the axial movement of said shaft means between two positions, said shaft means being manually shiftable from a locked position engaging said actuator body wherein said actuator body and said disabling means are keyed together to a release position disengaged from said actuator body whereby said disabling mean can be moved relative to said actuator body, said stop members limiting the axial movement of said shaft means between said locked position and said release position.

6. An actuating mechanism according to claim 5 wherein said retaining means includes an extension on said firing pin provided with an annular groove, a plurality of openings in said actuator body, and means keying said firing pin extension to said tubular body when said openings are in registry with said groove.

7. An actuating mechanism according to claim 6 wherein said keying means comprises a plurality of ball members partially disposed in said actuator body openings and partially disposed in said extension groove for maintaining said firing pin in said cocked position.

8. An actuating mechanism according to claim 6 wherein said disabling means comprises a sleeve slidable relative to said actuator body and having an enlarged inner diameter portion enabling said keying means to be displaced from said groove in said extension to permit said firing pin to be driven by said biasing means.

9. An actuating mechanism according to claim 8 including an elongated shaft having a reduced diameter portion, said actuator body having a reduced diameter portion, said shaft being movable into a position aligning the full diameter portion of said shaft with said reduced diameter portion of said actuator body to lock said disabling means and a position aligning said shaft reduced diameter portion with said body reduced diameter portion to release said disabling means.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

PATENT NO. : 3,881,394  
DATED : May 6, 1975  
INVENTOR(S) : Loyal G. Netteland

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 4, Line 5, "relasing" should be changed to  
--releasing--

Claim 5, Line 4, "and oxygen" should be changed to  
--an oxygen--.

Signed and Sealed this  
twenty-eight Day of October 1975

[SEAL]

*Attest:*

RUTH C. MASON  
*Attesting Officer*

C. MARSHALL DANN  
*Commissioner of Patents and Trademarks*

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[SEAL]

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